PATENT ABSTRACTS OF JAPAN

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(71)Applicant : FUJIKURA LTD

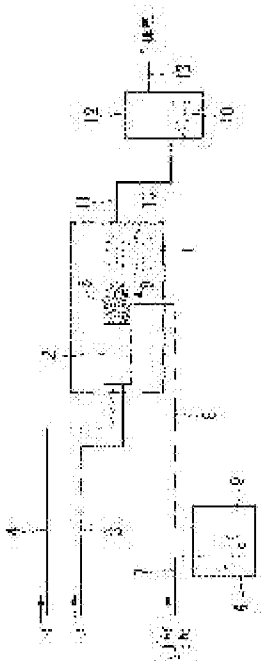
(72)Inventor : TERADA YOSHIHIRO
UEKATANO MITSURU
HIMENO KUNIHARU

(54) TITANIUM OXIDE PARTICLE

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a titanium oxide particle suitable as a photocatalyst, an efficient method for treating a pollutant or decomposing water using the titanium oxide particle as the photocatalyst and a manufacturing method of the titanium oxide particle.

SOLUTION: The titanium oxide particle suitable as the photocatalyst is manufactured by introducing a titanium compound vapor 9 into oxyhydrogen flame 5 while supplying an excessive amount of oxygen to simultaneously induce hydrolysis and thermal oxidation. The obtained titanium oxide particle 10 is spherical in shape, has a high sphericity, a large specific surface area, an average particle size as small as 10-100 nm and a particle size distribution comprising 85 vol.% particles of 10-40 nm, exerts a high photocatalytic activity and is excellent in dispersibility.



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CLAIMS

[Claim(s)]
[Claim 1]
A titanium oxide particle, wherein it has a meshes-of-a-net pattern in a particle surface, mean particle diameter is 10-100 nm and sphericity of particles is 0.1 or less spherical particle.
[Claim 2]
The titanium oxide particle according to claim 1 being a titanium oxide particle of an anatase type [% / not less than 70] of said spherical particle.
[Claim 3]
A photocatalyst becoming either claim 1 or claim 2 from a titanium oxide particle of a statement.
[Claim 4]
A disposal method of a pollutant carrying out one processing to if the photocatalyst according to claim 3 is made to contact a pollutant and there are little decomposition treatment, deodorization treatment, and germicidal treatment about this pollutant.
[Claim 5]
A decomposing method of water making the photocatalyst according to claim 3 contact water, and decomposing this water.
[Claim 6]
A manufacturing method of a titanium oxide particle introducing a titanium compound steam into an acid water matter flame, and making superfluous the amount of oxygen to supply and triggering a hydrolysis reaction and a thermal oxidation reaction simultaneously.
[Claim 7]
A manufacturing method of the titanium oxide particle according to claim 6 making an acid water matter flame generate using an acid water matter burner of glass multiple pipe structure.

[Claim 8]
A manufacturing method of the titanium oxide particle according to claim 7, wherein an amount-of-supply ratio of oxygen-hydrogen supplied to an acid water matter burner is 3/4 or more.

[Claim 9]

A manufacturing method of the titanium oxide particle according to any one of claims 6 to 8, wherein recovery of a titanium oxide particle is made with a bag filter provided downstream from a chamber which generates a titanium oxide particle.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This inventions are the method of processing a pollutant as a photocatalyst using a titanium oxide particle suitable as a photocatalyst, and this titanium oxide particle, the method of decomposing water, and a thing concerning the manufacturing method of this titanium oxide particle further.
[0002]
[Description of the Prior Art]
Titanium oxide particle (TiO2) particles have been widely used as paint, cosmetics, a food additive, etc. Examination of using it in order for a titanium oxide particle to make the photocatalyst effect which this holds decompose decomposition of NOx leading to air pollution and the organic solvent in which water pollution is made to cause is performed.
[0003]
By the way, the photocatalysis of a titanium oxide particle is a reaction which occurs on the surface.
So, it is desirable to make a decomposition target substance stick to a titanium oxide particle surface in disassembly of the above-mentioned pollutant.
namely, an adsorption area is large in order to decompose more efficiently -- it has high resolving power as the titanium oxide particle whose particle diameter it is desirable and is small.
[0004]
For this reason, in JP,11-267519,A and JP,7-303835,A, the titanium oxide particle which carried out minuteness making even to several nanometer order is proposed. However, as for those with a problem arising in dispersibility, and particle diameter, when it is considered as slurry form by the particles of several nanometer order, it is desirable to use not less than 10 nm.
[0005]
As for the titanium oxide particle used as a photocatalyst, reactivity and activity have little

dispersion, its uniform thing is preferred, and, so, a thing of particles with small particle size distribution is desired. It is desirable for separation from a particle synthesizer unit, a slurry mixing device, etc. and removing operation to be easy spherical particles.

[0006]

Since it is such, in JP,5-163022,A, the titanium oxide particle with sphericity it is spherical and high and comparatively small particle size distribution is proposed. However, the particle diameter of the titanium oxide particle proposed here is disadvantageous at the point that the specific surface area for adsorbing a decomposition subject required in order to decompose effectively by being set to 0.1 micrometers or more is small.

[0007]

On the other hand, in order to obtain the particles whose particle diameter is sufficiently small by the anatase-type-titanium-oxide particles which have photocatalyst activity as indicated by above-mentioned JP,5-163022,A, It is difficult to have to **** the titanium oxide particle calcinated or condensed with means, such as grinding, generally, therefore to obtain near [a real ball]-shaped titanium oxide particle particles.

[0008]

Although methods of obtaining particles without using ****** include the process which hydrolyzes and oxidizes titanium tetrachloride, titanium sulfate, etc. thermally, when particle diameter is made small in this case, the sphericity of particles will fall and go.

Thus, specific surface area is large and it has the requirements that sphericity is spherically high, and it is the actual condition which the titanium oxide particle suitable as a photocatalyst is not yet appearing, and the prompt appearance is desired.

[0009]

[Patent documents 1]

JP,11-267519,A

[Patent documents 2]

JP,5-163022,A

[0010]

[Problem(s) to be Solved by the Invention]

Therefore, there is a technical problem in this invention in providing the method of processing a pollutant efficiently as a photocatalyst using a titanium oxide particle suitable as a photocatalyst, and this titanium oxide particle, the method of decomposing water, and the manufacturing method of the still more suitable titanium oxide particle as this photocatalyst.

[0011]

[Means for Solving the Problem]

In order to solve this technical problem,

An invention concerning claim 1 is a titanium oxide particle, wherein it has a meshes-of-a-net pattern in a particle surface, mean particle diameter is 10-100 nm and sphericity of particles is 0.1 or less spherical particle.

An invention concerning claim 2 is the titanium oxide particle according to claim 1 being titanium oxide of an anatase type [% / not less than 70] of said spherical particle.

[0012]
An invention concerning claim 3 is a photocatalyst becoming either claim 1 or claim 2 from a titanium oxide particle of a statement.
It is a disposal method of a pollutant, wherein an invention concerning claim 4 carries out one processing to if the photocatalyst according to claim 3 is made to contact a pollutant and there are little decomposition treatment, deodorization treatment, and germicidal treatment about this pollutant.
An invention concerning claim 5 is a decomposing method of water making the photocatalyst according to claim 3 contact water, and decomposing this water.
[0013]
An invention concerning claim 6 introduces a titanium compound steam into an acid water matter flame, and it is a manufacturing method of a titanium oxide particle making superfluous the amount of oxygen to supply and triggering a hydrolysis reaction and a thermal oxidation reaction simultaneously.
[0014]
An invention concerning claim 7 is a manufacturing method of the titanium oxide particle according to claim 6 making an acid water matter flame generate using an acid water matter burner of glass multiple pipe structure.
An invention concerning claim 8 is a manufacturing method of the titanium oxide particle according to claim 7, wherein an amount-of-supply ratio of oxygen-hydrogen supplied to an acid water matter burner is 3/4 or more.
[0015]
An invention concerning claim 9 is a manufacturing method of a titanium oxide particle given in any 1 paragraph of claims 6 thru/or 8, wherein recovery of a titanium oxide particle is made with a bag filter provided downstream from a chamber which generates a titanium oxide particle.
[0016]
[Embodiment of the Invention]
Hereafter, this invention is explained in detail.
The titanium oxide particle of this invention makes the shape globular form particles with high sphericity. When the maximum diameter of the particle is made into L (max) and the minimum diameter L (min), a formula (1) defines the mean particle diameter L.

$$L = [L(max) \times L(min)]^{1/2} \quad \ldots (1)$$

[0017]
And the particles of the titanium oxide particle of this invention are characterized by the mean particle diameter L being 100 nm or less in not less than 10 nm.
The path of the particles which occupy 85 capacity % of the whole particle set thing has particle size distribution of 40 nm or less at not less than 10 nm.
[0018]
The mean particle diameter L is 10 nm - 30 nm, and photocatalyst activity is high in respect of saying that the titanium oxide particle particles whose paths of the particles which occupy 85

capacity % of the whole particle set thing are not less than 10 nm 25 nm disassemble a contaminant, and it has the outstanding characteristic.

[0019]

A formula (2) defines the sphericity D of particles.

D= [{L(max)-L(min)}/L] x100 .... (2)

And the particles of the titanium oxide particle of this invention have the sphericity D in sphericity being high or less by 0.1. Since it not only says that sphericity is high and the titanium oxide particle to which particle diameter is equal is high efficiency as a photocatalyst, but excels in plasticity and dispersibility as paints currently used conventionally, it has a high characteristic function.

[0020]

drawing 1 and drawing 2 are what shows the scanning electrical-and-electric-equipment microphotograph of the titanium oxide particle of this invention of the above modes -- the photograph of drawing 2 -- partial expansion of drawing 1 -- it carries out.

With the photograph of drawing 1 and drawing 2, it is checked that the titanium oxide particle of this invention is making the particles which have the requirements for a size which were described above so that clearly.

It has the feature for the titanium oxide particle particles of this invention to have a meshes-of-a-net pattern in the surface, so that it may accept with the photograph of drawing 2.

[0021]

Although the titanium oxide particle of this invention has the feature to consist of a titanium oxide particle of the anatase type [% / not less than 70] of the whole particle set thing, it is much more preferred that not less than 90% consists of anatase type titanium oxide particles in that a contaminant is disassembled. and when using it as paints, the effect is demonstrated more -- making -- it is desirable that it is an inertness rutile type optically.

[0022]

And it has the feature which can be made to change to a rutile type by heat-treating the particles of the titanium oxide particle of this invention at the temperature of not less than 700 **. Although we are anxious about specific surface area becoming small by the sintering operation at the time of heat treatment in this case, or particle shape changing, since crystallinity is high compared with the conventional spherical titanium oxide particle, a sintering phenomenon is controlled and change of particle diameter or shape does not take place easily.

[0023]

The titanium oxide particle of this invention which has the above features can be effectively used as a photocatalyst. That is, a photocatalyst effect is demonstrated by applying the titanium oxide particle of this invention on a substrate, and making it adhere by a proper means. For example, carrier fluid, such as an organic solvent, is made to distribute a titanium oxide particle, it is considered as a paste, this paste is applied on substrates, such as glass, ceramics, metal, wood, a plastic, or a coat, and it functions as a photocatalyst by irradiating this with lights, such as ultraviolet radiation.

[0024]

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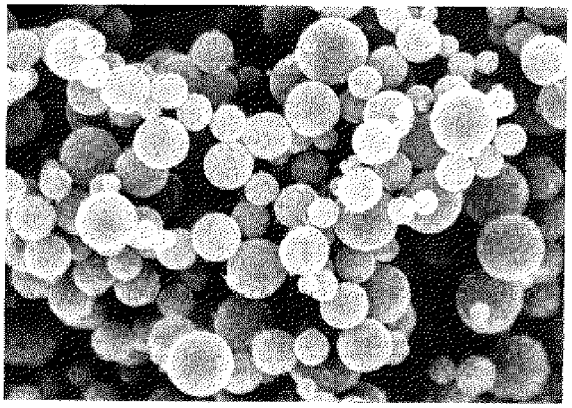
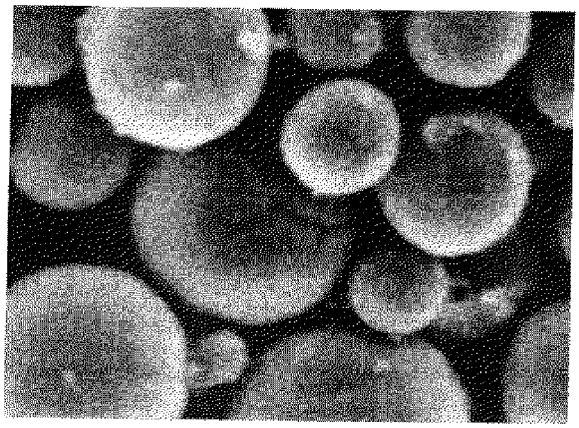
DRAWINGS

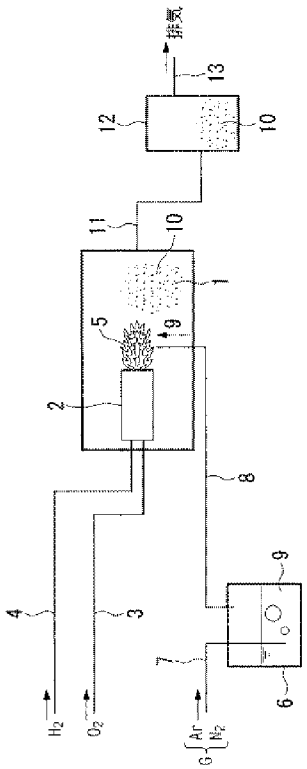
[Drawing 1]



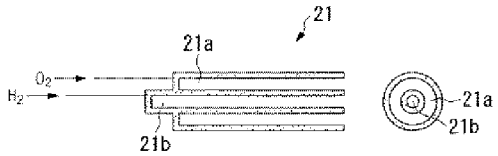
[Drawing 2]



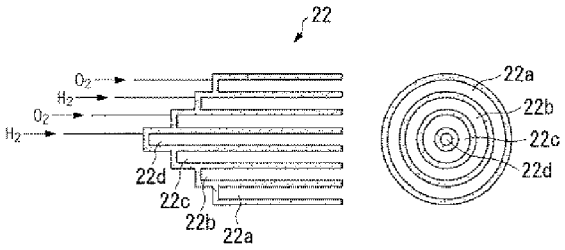
[Drawing 3]



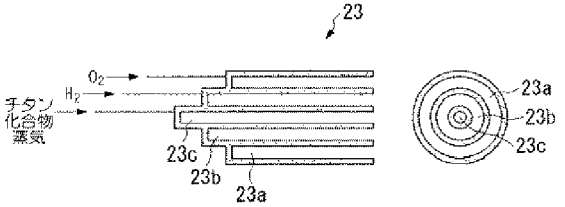
[Drawing 4]



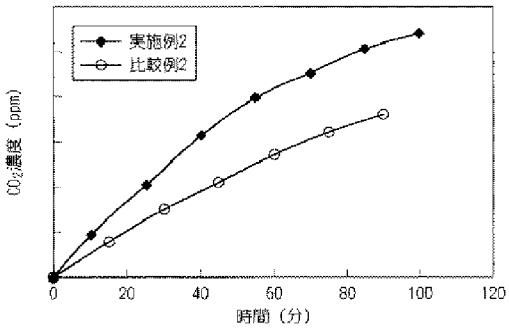
[Drawing 5]



[Drawing 6]



[Drawing 7]



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